

## Wildland Fire Chain Saws, S-212

### Unit 3 - Chain Saw Tasks and Techniques

**OBJECTIVES:** Upon completion of this lesson, the student will be able to:

1. Define the components required to complete a thorough hazard assessment for bucking, limbing, brushing, and falling operations.
2. Define types of binds and bucking methods.
3. Introduce the procedural approach to limbing, brushing and slashing, bucking, and felling.

## I. LIMBING

The following safety precautions must be strictly adhered to when limbing; noncompliance could result in a serious injury or fatality.

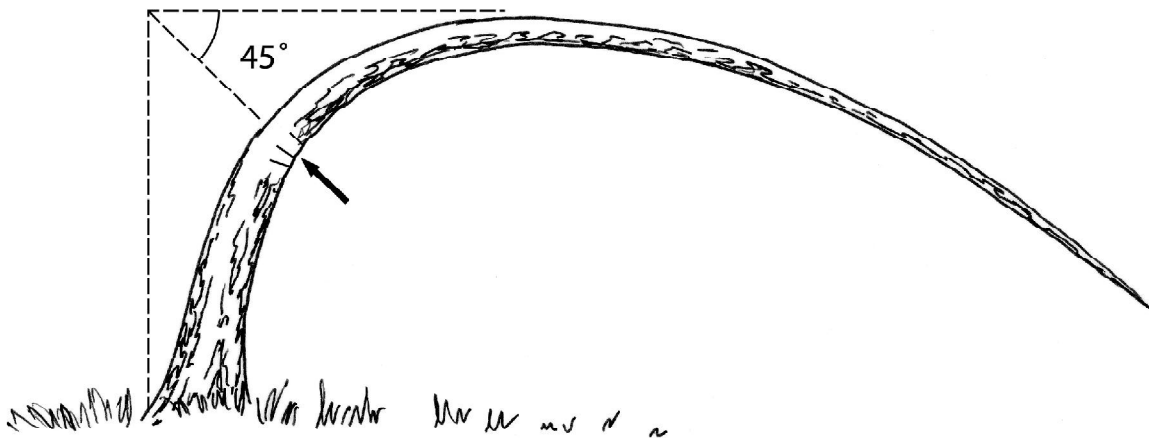
- A. Check for overhead and ground hazards before *any* limbing begins.
  - If a specific portion of the tree you are limbing has any overhead hazards, leave that portion of the tree unlimbed.
- B. Check for objects on the ground such as stumps, logs, and spring poles that may be hidden by the limbs of the felled tree.
  - If the tip of the bar inadvertently strikes an object, the saw may kick back.
- C. Maintain a firm grip on the saw with your thumb wrapped around the handlebar during all limbing activities, regardless of the direction in which the saw is turned.
  - Lock the left elbow and stand to the side of the kickback arc.
- D. Identify the direction the log may roll or move when the limbs are removed and avoid being in the path of the log.
  - Be sure you have firm footing as you are limbing.
  - Do not step forward until the limbing cut is complete.

- E. Identify the limbs which are supporting the tree's weight.
- Do not attempt to cut those limbs off in a manner that would allow the tree to roll or strike you.
  - Plan to remove these limbs last in an order that allows the tree to make a slow controlled fall to the ground.
  - Whenever given the opportunity to safely buck a portion of the tree off, do so to reduce the weight of the tree.
  - Always clear and plan an escape route.
- F. When limbing a log, right-handed sawyers should limb the right side out to the top before turning around and limbing the other side on their way back.
- Another option is to limb a tree out in sections. It is advisable to limb the far side of the log first, resting the saw's weight on the bole, keeping the bole between the bar and the sawyer as added protection.
  - Crossing over when limbing could result in injury.
    - Sawyers should select chain saw powerhead and bar length combinations based on their physical ability to manage the saw.
    - Bar length should be appropriate for the cutting task based on the size and type of material to be cut.
    - Bend at the knee and hips to maintain good body balance. Avoid bending at the waist to reduce back fatigue.

- G. Limbing kickbacks occur when the upper quadrant of the bar tip contacts an object and the chain is stopped.
- The rotating force of the chain is transferred to the saw body in a direction away from the cut.
  - Chance of injury depends on how well the sawyer maintains control of the chain saw, or if their body is positioned out of the kickback arc.
  - To reduce the chance of cutting the chaps or legs when limbing, only step forward when the chain has stopped moving, or when the guide bar is on the opposite side of the stem or log.
  - Over-reaching is generally at fault for limbing kickbacks. The shorter the bar the more severe the kickback. Modern saws are equipped with an inertial brake that automatically engages the chain brake before the hand guard reaches the hand.
  - The chain is more likely to be thrown when you are working with small material. Check the chain tension often. Sawing close to the ground increases the chances of kickback and damage to the chain. Watch out for rocks and other debris.

- H. Spring poles are limbs or small trees that are bent over and are under extreme tension.

Spring poles are encountered frequently when limbing. They can cause serious injury. If spring poles are not cut properly, they can spring back and strike the sawyer or throw the chain saw back into the sawyer.



Sawyers must recognize spring poles and use the proper technique when cutting them. One of two methods may be used:

1. Stand back at a safe distance. Make a series of shallow cuts less than one half of the spring pole's diameter in the compression side and roughly  $\frac{1}{2}$ " apart. As soon as movement or pinch is detected, remove the saw and begin the next cut. Four to six cuts should be sufficient. The release cut is then made from the top, about  $\frac{1}{2}$ " past the cuts towards the small end of the spring pole. Stand back and stay clear of the pole as the final tension is released.
2. Stand back at a safe distance and shave (or cut) with the compression arc of the spring pole, only cutting in the width of the saw chain. Once the spring pole starts to move, step away from it as it breaks. After the pressure is reduced, make the release cut in the tension side of the spring pole.

I. Sometimes a tree is suspended off the ground by the limbs underneath or by uneven terrain.

- The sawyer must decide whether or not to limb the tree after considering the potential that the sawyer might fall or that the tree may roll or collapse.
- Consider footwear and environmental conditions such as rain, snow, fog, or darkness, and the ability and experience of the sawyer.
- Carefully select the appropriate technique, such as limbing from the ground, limbing on top, or lowering the tree by bucking.

## II. BRUSHING AND SLASHING

### A. Sizeup and Safety Considerations

Many sawyers have cut their chaps or their legs when they took a step toward the next tree. Be sure the chain has stopped before moving to the next cutting location.

Engage the chain brake when moving even short distances. Never rest the bottom of the powerhead against the leg, only the powerhead's sides.

Shut the saw off when moving farther than from tree to tree, when hazardous conditions exist (slippery surfaces or heavy underbrush), and whenever moving more than 50 feet.

When slashing (felling) trees smaller than five inches in diameter, an undercut may not be needed. Instead, a single horizontal cut (kerf face) one-third the diameter of the tree may be used to fell it.

A good rule to follow is to undercut any tree that can't be picked up with one hand. When directional felling is necessary, use a conventional face cut (see the falling section).

Situations when directional felling of small trees should be used include:

- A potential barber-chair situation
- A closed canopy
- Tree defects
- Side binds
- Environmental damage

**Other Safety Considerations**—Always escape (retreat from) the stump quickly even when felling small-diameter trees. They can cause serious injuries and fatalities.

Trees should be pushed over only by the sawyer, only when the sawyer can do so safely, and only after the sawyer has looked up for overhead debris that could become dislodged.

## B. Safe and Efficient Brushing and Slashing Techniques

In dense fuel accumulations, the tip of the guide bar may accidentally bump (stub) into a limb. The sawyer must continually be alert for kickback.

The sawyer normally will have a swamper (hand piler) working nearby helping to remove cut debris. The swamper's safety must be taken into consideration. It is the sawyer's responsibility to maintain cutting area control and to communicate their intentions to the swamper. A system of non-verbal communication must be worked out to ensure the safety of the sawyer-swamper team.

Proper stance and saw handling is imperative. In addition, the following steps should be taken.

- ***LOOK UP*** for widow makers and other loose debris. Do not cut under a hazard. Remove the hazard or move the cutting location.
- Watch out for whipping limbs and branches when cutting smaller material. Cut close to the stem. Begin and complete cuts with a sharp chain and high chain speed. Use eye protection.
- Cut limbs and stems flush with the trunk or close to the ground. Do not leave stubs (pointed stems) that could cause injury during a fall or cause the sawyer or others to trip.
- Do not cross the chain saw in front of your legs. Keep some distance between your legs and the guide bar. Bend down to maintain distance. Cut on one side, then the other to avoid crossing the chain saw in front of you.
- Never cut with the chain saw above shoulder height. Control is difficult when the saw's weight is above your shoulders. A thrown chain could strike you in the face or upper body.
- Clear debris from the cutting location to prevent the guide bar tip from stubbing it accidentally. When you are removing debris, engage the chain brake or turn off the ignition.
- Watch out for spring poles. Do not cut spring poles if you can avoid doing so.
- When cutting a heavy limb, consider using a small cut opposite the final cut to prevent the material from slabbing or peeling off.



- Pay special attention if you are working in close quarters with other workers in an area with steep slopes and thick brush or logging slash.
  - First, stop and size up the situation. Make a plan and talk it over with all workers in the area. A well thought-out plan saves time and reduces the risk of accidents.
  - After you have discussed the plan, work systematically from the outside in and from downhill up. This reduces the chance that material will hang up. Maintain a space between workers that is no less than two times the height of the tallest tree.
- You need one or more escape routes, even when felling small trees.
- School marm's (double stumps) are hazardous because they present a high potential for causing kickback. Watch that bar tip!
- When felling small trees, cut the stumps as close to the ground as possible without hitting the ground with the chain. Stumps are cut low so they will not be as noticeable and will present fewer hazards to people.
- Small trees can be limbed while they are standing. Do not cut with the chain saw above shoulder height. Limbing the bottom of small trees allows the sawyer to move in closer to the bole when felling it, and will help the sawyer watch the tip of the bar to prevent kickbacks.
- Draw the saw back towards you as you start the cut to maintain chain speed. Sudden stops to the chain near the tip often derail the chain from the bar.

- Remember, when you saw up from the bottom (using the top of the bar) the saw will push back rather than pull away. This increases the risk of kickback and loss of control. Be aware of signs of fatigue such as more frequent kickbacks, bar pinches, and near misses. Take a break at the first signs of fatigue.
- Cut pieces small enough so they are easy to lift and handle by hand. Lift properly using the legs and keeping the back straight.

Swampers must anticipate the sawyer's movement and the movement of the chain saw, be aware of their own footing and escape routes, and watch out for flying debris.

### III. BUCKING

#### A. Proper Use of Dogs

Learn to use the saw's dogs as a pivot point when felling or bucking. Use the dogs to support the saw's weight. This technique will enhance your control of the saw and improve the saw's efficiency while reducing fatigue.

#### B. Bucking

1. Situational awareness
  - a. Never buck a tree that exceeds your ability.
  - b. Complete an overhead and ground hazard analysis.
  - c. Is the guide bar long enough for the log that is being bucked?
  - d. Establish good footing.
  - e. Swamp out bucking areas and escape routes. Anticipate what will happen when the log is cut.

- f. Plan the bucking cut carefully after considering:
- Slope: people and property in the cutting zone.
  - Tension: limbs and spring poles, side of log under tension and possible log movement after the release cut.
  - Compression: falling or rolling root wads, side of log under compression, possible movement as release cut is completed.
  - Rocks and foreign objects on the log. The log's tendency to roll, slide, or bind.
  - Pivot points: objects under the log that can allow it to swing around and strike the sawyer as the release cut is completed. Adjust the cutting plan to mitigate this hazard. Stand to the side of the cut to avoid the swinging end.
    - Ensure adequate escape routes are in place. Be aware of broken limbs, rocks or other objects hidden underneath the log that can roll up to hit the sawyer.
- g. Complete a hazard analysis prior to bucking:
- Assess the area for overhead and ground hazards to be mitigated before beginning bucking.
  - Special hazards like leaners and snags need to be taken care of right away. Drop hazard trees to the ground so no one has to work under them.
  - Size up the log for tension and bind, and possible reaction after the release cut has been completed.

- Establish escape routes and clear any obstacles that might inhibit your escape.
- Identify and mitigate spring poles.
- Cut slowly and observe the kerf for movement that will indicate where the bind is. A log can have different types of binds at different places.

## 2. Safe and efficient bucking techniques

In most situations it is safest to buck logs from the uphill side unless the log might move uphill when bucked. This could occur because of the log's position, weight distribution, and pivot points.

Always determine the number and type of binds and pivot points. Consult another sawyer if you have questions.

Begin bucking by cutting the offside first. This is the side the log might move to when it is cut, usually the downhill side. Cut straight down until you have space for a wedge.

Insert a wedge or wedges to prevent the cut (kerf) from closing tightly and pinching the bar.

Understanding directional pressures—or binds—is important for safe and efficient cutting. These binds determine bucking techniques and procedures. Look for landforms, stumps, blow-down, and other obstacles that prevent a log from lying flat, causing binds. When a bind occurs, different pressure areas result.

The tension area is the portion of the log where the wood fibers are being stretched apart. In this portion of the log, the kerf opens as the cut is made.

The compression area is the portion of the log where the wood fibers push together. In this portion of the log, the kerf closes as the cut is made.

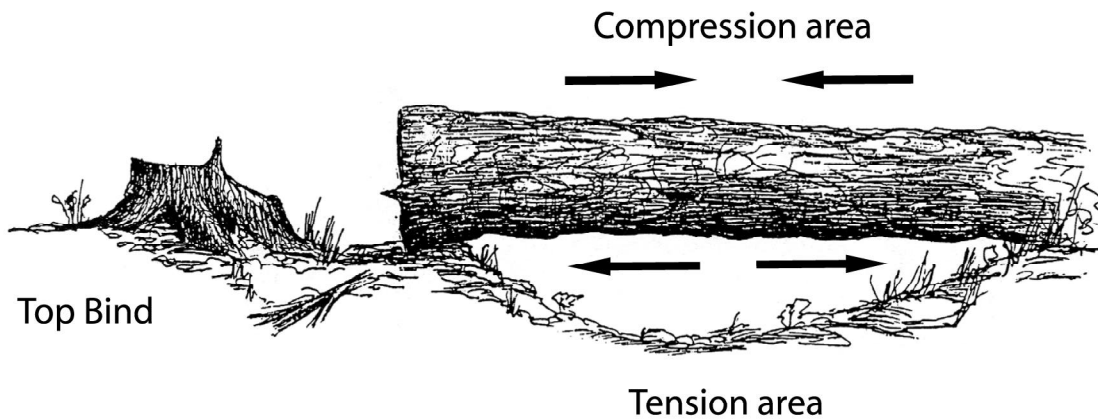
It is extremely important to determine where the log may move when it is cut. Inspect the log for all binds, pivot points, and natural skids. Various bucking techniques can be used to lower a suspended tree to the ground. Always be prepared for unanticipated movement of the log or round as the release cut is completed.



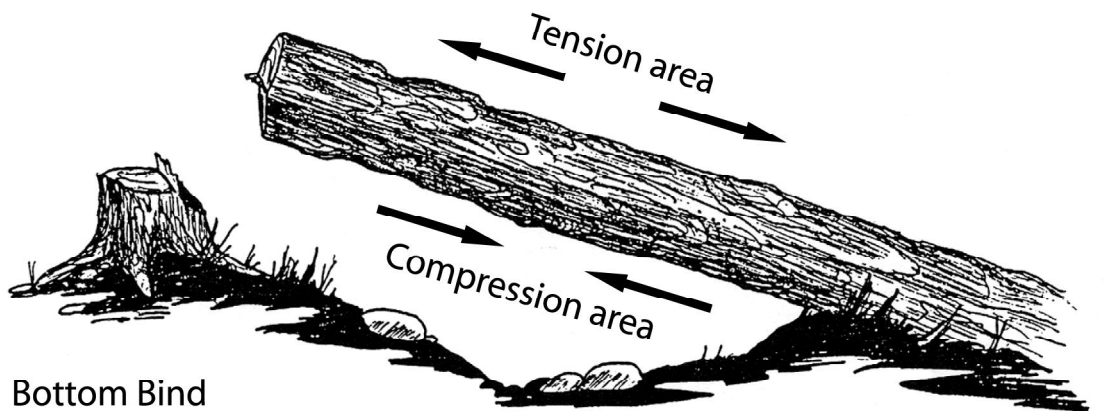
### 3. Determining bind

The four types of bind are: top, bottom, side, and end. There may be a combination of binds. Normally, logs have a combination of two or more binds.

- Top bind—The tension area is on the bottom of the log. The compression area is on the top.

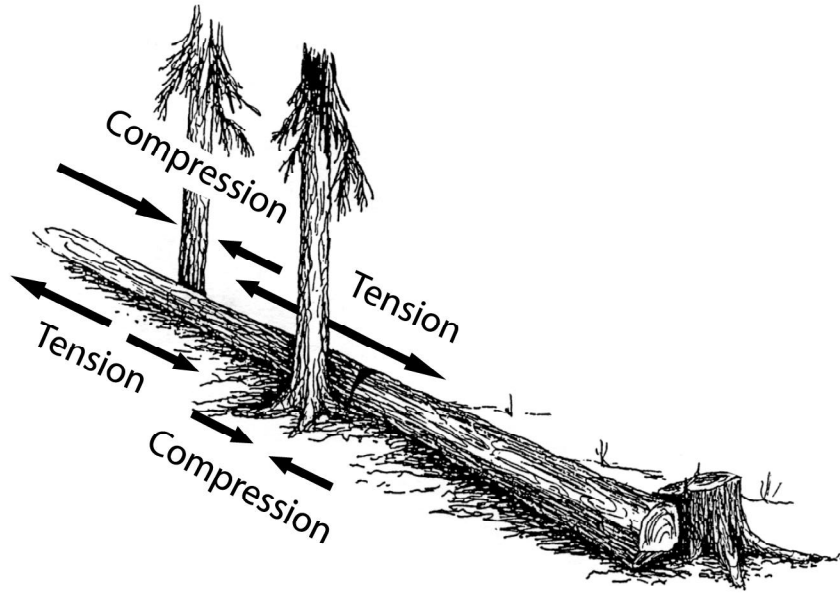


- Bottom bind—The tension area is on the top of the log. The compression area is on the bottom.

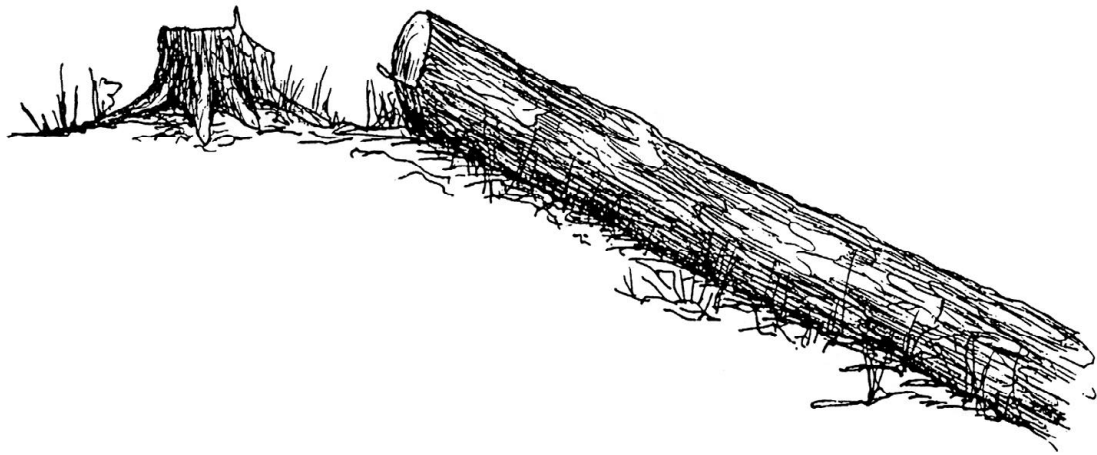


- Side bind—Pressure is exerted sideways on the log.

Side Bind



- End bind—Weight compresses the log's entire cross section.



Buck from the top down. It is best to start bucking at the top of the log and work toward the butt end, removing the binds in smaller material first. Look for broken limbs and tops above the work area. Never stand under an overhead hazard while bucking.

Look for small trees and limbs (spring poles) bent under the log being bucked. They may spring up as the log rolls away. If you can do so safely, cut these hazards before the log is bucked. Otherwise, move to a new cutting location and flag the hazard.



Determine the offside. It is the side the log might move to when it is cut—normally the downhill side. Watch out for possible pivots. Clear the work area and escape paths. Allow more than eight feet of room to escape when the final cut is made. Establish solid footing and remove debris that may hinder your escape.

Cut the offside first. If possible, make a cut about one-third the diameter of the log. This allows the sawyer to step back from the log on the final release cut, using only the forward portion of the guide bar. Do not let the tip of the bar pinch if the cut begins to close or to strike an object, causing kickback.



Watch the kerf to detect log movement. Position yourself so you can detect a slight opening or closing of the kerf. There is no better indicator of the log's reaction on the release cut. If the bind cannot be determined, proceed with caution.

It may be necessary to move the saw back and forth slowly in the kerf to prevent the saw from getting bound as the kerf closes behind the guide bar. Cut only deep enough to place a wedge. Continue cutting. Watch the kerf. If the kerf starts to open, there is a bottom bind; if the kerf starts to close, there is a top bind.

Reduce the remaining wood. Visually project the cut's location to the bottom of the log. Reduce the amount of wood for the final cut by cutting a short distance into the log along this line. Be prepared for kickback.

Determine the cutting sequence. The sequence of the remaining cuts depends on the type of bind. Generally, the next cut will be a small, less than 1½ inches wide, pie-shaped cut removed from the compression area. The log can settle slowly into this space, preventing dangerous slabbing and splintering. This practice is extremely important when cutting large logs.

The final cut, or release cut, will be made through the tension area. Because the offside has been cut, the sawyer only has to use enough bar to finish cutting the remaining wood. This allows the sawyer to stand back, away from the danger.

The location of the pie-shaped section and the release cut vary depending on the type of bind:

- **Top Bind:** Remove the pie-shaped section from the top, then make the release cut from the bottom.
- **Bottom Bind:** Remove the pie-shaped section from the bottom, then make the release cut from the top.
- **Side Bind:** If you are not certain the job is safe, do not make the cut. Normally, the offside is the side with tension; the tension side is usually bowed out (convex). Look for solid trees with no overhead hazards or other objects that you can stand behind for protection while cutting.

Remove a pie-shaped section from the compression area, then make the release cut in the tension area.

- **End Bind:** Cut from the top down, inserting a wedge as soon as possible. Finish by cutting down from the top. Watch the wood chips to make sure that the chain is not cutting in the dirt (look for dark or bark colored chips).

Pay special attention when bucking in blowdown. Blowdown is a result of strong winds that have uprooted the trees. At any time while the bucking cuts are made, the roots can drop back into place or the butt may roll. Consider the following points when bucking blowdown.

If possible, start limbing and bucking the blown down tree from the top and work your way toward the stump/root wad. Limb and buck observing normal assessments prior to beginning.

Try to work small sections at a time varying the length of each section based on the size of the tree being worked on. In general, the larger the diameter or length of the tree, the smaller the bucking section (keeping in mind the maximum size to make hand removal easiest).

Small trees growing on the roots of blow-down could be forced into the sawyer's position if the roots drop or roll. Cut the small trees off first. Limbs may be preventing the roots from rolling. Do not cut those limbs. The roots can move in any direction. Avoid standing directly behind or downhill from them.

#### 4. Safe bucking practices

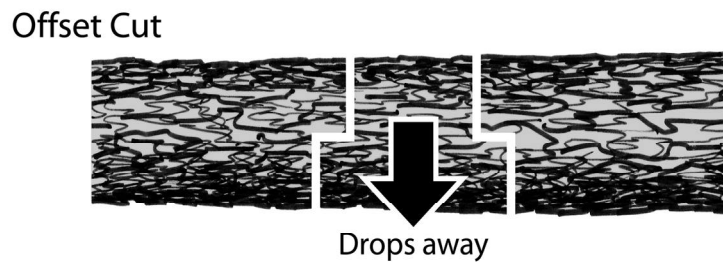
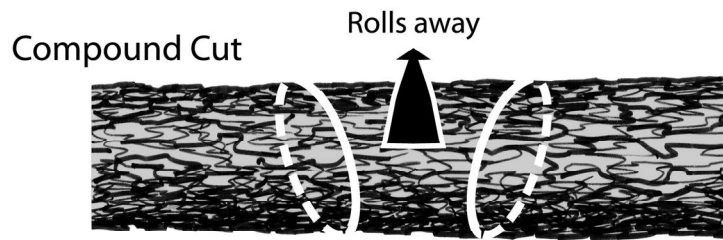
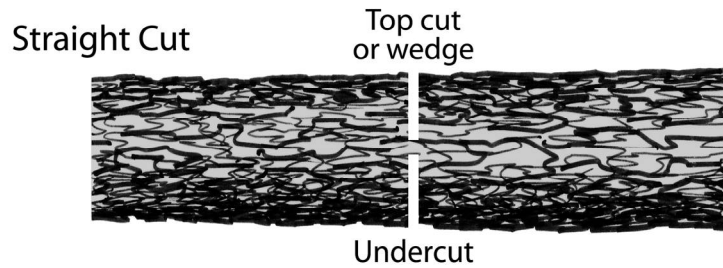
Warn workers that are in and below an active cutting area. Allow workers time to move to a safe location. Verify their safety visually and verbally, and get confirmation back. Announce when a bucking operation has been completed.

Never approach a cutting operation from below until the saw has stopped running, you have established communication with the sawyer, and the sawyer has granted permission to proceed.

When bucking on slopes, place a block downhill to prevent rollout of the cut portion.

Buck small sections that will be easy to control when they begin moving. Removing a single section of log may require that other binds be eliminated first.

Angle bucking cuts, wide on top and made on the offside, allow a single section of log to be removed. Angled cuts will permit the bucked section of log to be rolled away from the remaining log.



All logs must be completely severed when bucked. Flagging should be used to mark an incompletely bucked log as a hazard.

## 5. Points to remember

- Do a complete sizeup. Identify the hazards, and establish your escape routes and safe zones.
- Use rocks, stumps (if they are tall enough), and sound standing trees with no overhead hazards for protection in the event the tree springs sideways toward the sawyer when the release cut is made.
- Binds change with log movement. Reevaluation of binds is necessary as sections of the log are removed.
- Allow the saw to rest on log, using the dogs as a pivot point for each cut.

## IV. BASIC FELLING

### A. Situational Awareness

Analyze the felling job by considering:

#### Tree characteristics:

- Species
- Live or dead
- Sound or soft
- Diameter and height
- Widow makers and/or hangups
- Frozen wood
- Heavy branches or uneven weight distribution
- Direction of lean(s)
- Degree of lean (slight or great)
- Head lean or side lean
- Stand health

Soundness or defects:

- Deformities, such as those caused by damage from weather, lightning or fire
- Spike top
- Nesting or feeding holes
- Cat face
- Splits and frost cracks
- Twin or devil top, school marm
- Bark and trunk soundness
- Deformities, such as those caused by mistletoe
- Rusty (discolored) knots
- Punky (swollen and sunken) knots
- Unstable root system or root protrusions
- Wounds or scars
- Split trunk
- Human-made hazards

Analyze the base of the tree for:

- Thud (hollow) sound when struck
- Insect activity
- Conks and mushrooms
- Feeding holes
- Rot and cankers
- Bark soundness
- Shelf fungi or “bracket”
- Resin flow on bark
- A swollen base indicates potential for hollow bole in hardwoods

Examine surrounding terrain for:

- Steepness
- Stumps
- Irregularities in the ground
- Loose logs
- Draws and ridges
- Ground debris that can fly or kick up at the sawyer
- Rocks

Examine immediate work area for:

- People, roads, or vehicles
- Reserve trees (signed to mark administrative boundaries and location monuments)
- Power lines or fences
- Underground utility lines
- Structures
- Hang ups and widow makers
- Openings to fall trees
- Other trees that may be affected
- Snags
- Fire-weakened trees
- Other trees that may have to be felled first
- Hazards such as trees, rocks, brush, low-hanging limbs
- Footing

B. Sizeup

Before starting the saw, the chain saw operator must be able to evaluate if a tree is safe to cut. Other options are always available.

***IF FELLING A PARTICULAR TREE IS DANGEROUS,  
DON'T DO IT!***

Debris falling from above causes over one-half of all falling accidents. Practice watching overhead while cutting, with occasional glances at the saw, the kerf, and the top of the tree.

**Observe the Top** - When you approach the tree to be felled, observe the top. Check for all overhead hazards that may come down during felling.

Look at the limbs. Are they heavy enough on one side to affect the desired felling direction? Are the limbs entangled with the limbs of other trees? If so, they will snap off or prevent the tree from falling after it has been cut.

Is the wind blowing strongly enough to affect the tree's fall? Remember that surface wind speeds are less than those 20' and above the surface. Wind speeds greater than 15 miles per hour may require that felling be stopped. Strong winds could also blow over other trees and snags in the area. Switching or erratic winds require special safety considerations.

**Check for Snags** - Check all snags in the immediate area for soundness. A gust of wind may cause snags to fall at any time, as may the vibration of a tree fall. If it is safe to do so, begin by felling any snag in the cutting area that poses a threat.

**Swamp Out the Base** - Clear small trees, brush, and debris from the base of the tree. Remove all material that could cause you to trip or lose your balance. Also remove material that will interfere with the saw, wedges, and ax. Look for small trees and brush that could accidentally stub the guide bar. Be careful not to fatigue yourself with unnecessary swamping. Remove only what is needed to work safely around the base of the tree.

**Many fatalities have occurred because the sawyer did not move away far enough from the stump to avoid being struck or pinned.**



### **Assess the Tree's Lean and the Soundness of the Holding Wood -**

Most trees have two natural leans; the predominant head lean and the secondary side lean. The leaning weight of the tree will be a combination of these two leans. Both must be considered when determining the desired felling direction.

The desired felling direction can usually be chosen within 45° of the combined lean, provided there is enough sound holding (hinge) wood to work with, especially in the corners of the undercut.

Evaluate the tree's lean. With a plumb bob or axe, project a vertical line up from the center of the tree's butt and determine whether the tree's top lies to the right or left of the projected line. Always establish the desired lay based on the predominate lean while considering overhead and ground hazards.

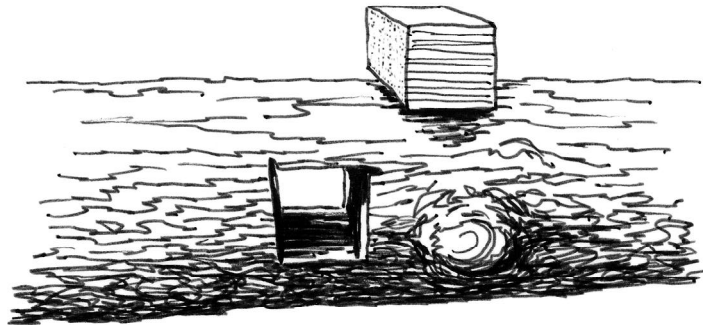


A pistol-grip tree may appear to be leaning in one direction while most of the weight is actually in another direction.

Look at the treetop from at least two different spots at right angles to each other. This will be done again in the sizeup process.

The importance of the hinge (or holding wood) cannot be overemphasized. Determine the condition of the tree's holding wood by sounding it with an axe. A sound tree will produce a "solid" sound. A soft tree will produce a "soft" sound or "thunk." Look up for falling debris while doing so.

Boring to determine a tree's soundness is an important technique, but it must be done properly because it has the potential for kickback. Using the guide bar tip, bore vertically into the area 90 degrees from the hinge behind the holding wood.



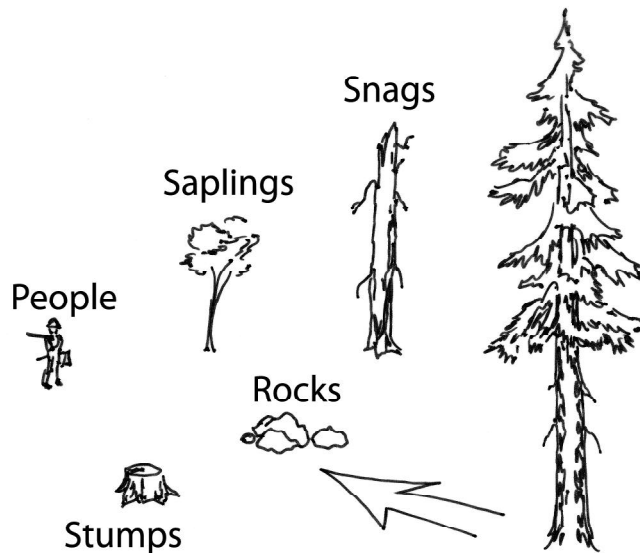
Do not weaken the holding wood by boring into or across any of the holding wood. The color of the sawdust and ease with which the saw enters the wood will be your indication of the tree's soundness.

Begin the boring cut with the power head lower than the tip of the bar. Apply full throttle and start cutting with the lower quadrant of the guide bar tip. Once the tip of the saw is in the tree, orientate the guide bar straight into the tree. Maintain full throttle throughout the boring cut. The left hand thumb must be wrapped around the handlebar.

Check for frost cracks or other weak areas in the holding wood. The desired felling direction can be adjusted to eliminate weaknesses in the holding wood. The depth of the undercut can also be adjusted (less than one-third the tree's diameter or greater than one-third) so that the holding area takes advantage of the soundest wood available.

### C. Escape Routes and Safe Zones

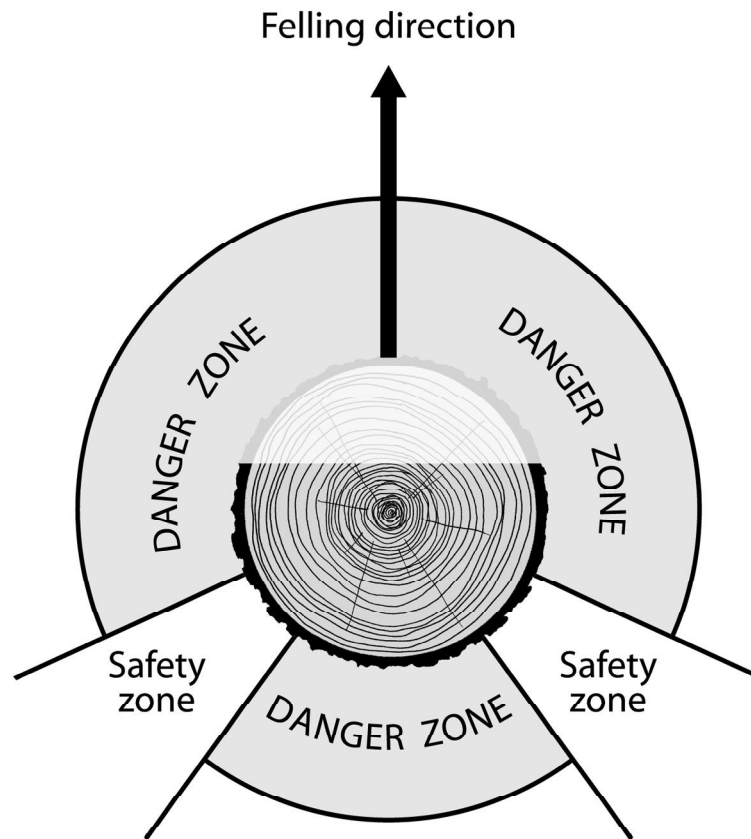
Walk out and thoroughly check the intended lay or bed where the tree is supposed to fall. Look for dead treetops, snags, and widow makers that may cause throwbacks, allow the tree to roll, or result in another tree or limb becoming a hazard.



The escape route and alternate routes must be predetermined paths where the sawyer can escape once the tree is committed to fall. Escape routes and safe zones should be no less than 20 feet from the stump and 45° to the sides and back from the direction of the fall. Sawyers must select and prepare the work area and clear escape routes and alternate routes before starting the first cut.

With the desired felling direction in mind, determine your escape route. Consider which side of the tree you will be making your final cut on and select a path that will take you at least 20 feet away from the stump when the tree begins to fall.

**Do not choose a path directly behind the tree.** It is best to prepare two escape routes in case you switch your location on the final cut.



Look for a large solid tree or rock for protection. The tree or rock must be at least 20 feet away from the stump and not be directly behind it. Make sure that debris that could trip you is cleared from the escape route. Practice the escape.

Walk out the intended lay of the tree. Look for any obstacles that could cause the tree to kick back over the stump or cause the butt to jump or pivot as the tree hits the ground. Look for any small trees or snags that could be thrown into your escape route.

Using the observations you made walking out the lay, reexamine the escape route. Be sure that your chosen route will be the safest escape **before** you begin to cut.

#### D. Observers and Spotters for Felling Operations

The use of personnel other than swampers in felling operations continues to be controversial. The USFS *Health and Safety Code Handbook* states that if you choose to have additional personnel (such as during training), justification for the additional personnel and the implementation process shall be documented in the JHA.

The Fireline Handbook requires a spotter for all fireline felling operations. The wildland fire chain saw operator must always work in a team of two in order to summon help in case of mishaps.

The additional sawyer or swamper can assist in cutting area control and operational analysis, but once the cutting operation begins, **the reliance on the team member to warn the operator, that is as a lookout, is an unsafe practice.**

This practice is unsafe for two primary reasons:

- Possible temporary distraction of the lookout (wasps, fire runs, aerial activity) could leave the sawyer vulnerable at a critical moment.
- Relying on a lookout's warning often leaves the sawyer inattentive to their own safety.

Even as the lookout observes a hazard to the sawyer, there is no effective method to deliver a warning to the sawyer to escape in sufficient time.

Once the sawyer is committed to the backcut their total attention must focus on safely completing the cut, and cannot be distracted by lookouts or concerns over their location.

Often you may hear an argument for a lookout as a wedge driver for the fatigued or fatiguing sawyer. **WRONG!** The chain saw should be out of the sawyers hands long before then.

Check to be sure the cutting area is clear of people. If a swamper or falling boss is present, they must remain no less than two tree lengths away from the tree to be felled.

Brief the swamper to assist with cutting area control to prevent other workers from entering the falling area.

#### E. Felling the Tree

“Face” the tree. The face is made in the direction you want the tree to fall. Estimate one-third of the tree’s diameter, shout a warning, and proceed with the undercut. While cutting, glance at the tree’s top for falling debris. When finished, check the direction the tree is faced. If the face is not in the desired felling direction, correct the cut.

Shout a warning. Shut off the saw and shout to be sure that the cutting area is secure. Reexamine your primary and secondary escape routes before beginning the backcut.

Complete the backcut. Remembering the importance of hinge wood, stump shot and wedging, complete the backcut.

Escape (or retreat) the stump. When the tree commits to the fall, rapidly follow your escape route. Do not hesitate at the stump. If the saw becomes stuck, leave it. If carrying the saw prevents you from escaping quickly enough, drop it!

Keep your eyes on your predetermined escape route and on the falling tree. If the felled tree strikes other trees, they may still be moving after the tree has fallen. Watch for flying limbs and tops. Remain in your safe zone until it is safe to approach the stump.

Analyze the Stump. The stump gives the best critique of the felling operation. Before approaching the stump, look in the tops of the surrounding trees for new overhead hazards.

Take time to analyze the felling operation:

- Is the hinge wood even across the face of the tree?
- How much holding wood is left on each corner?
- Is the stump shot sufficient?
- Were the cuts level?
- Check the stump height and look for stump or root pull and dutchman cuts. Did the tree fall to the desired lay? How far from the center of the predetermined lay is the top?

#### F. Felling Details

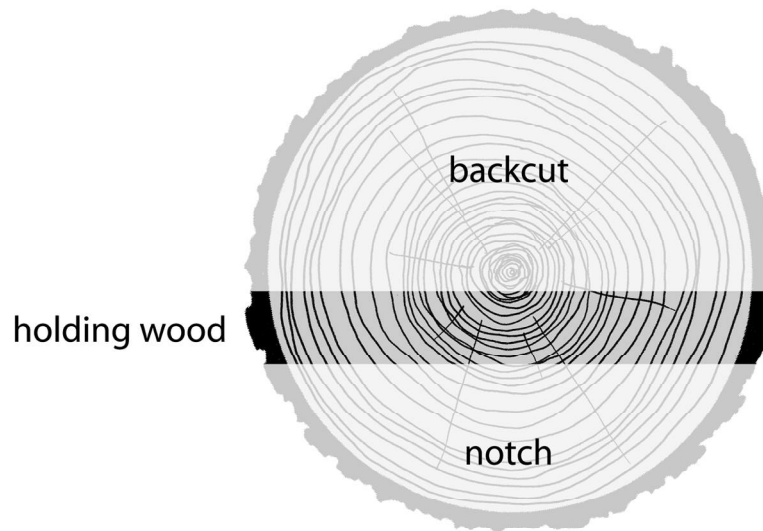
Proper evaluation of a felling operation requires a thorough understanding of the mechanics of the undercut, hinge/holding wood, backcut, and the felling procedure. In addition, the sawyer needs to consider the various problems the individual tree presents.

Every tree should be evaluated or sized up using techniques discussed in the Situational Awareness-Individual Complexity Checklist.

##### 1. The undercut, holding wood, and backcut

The three basic face cuts are the conventional undercut, the Humboldt, and the Open-face Notch. We are only going to discuss the conventional undercut due to its broad application for all timber types and because it provides a solid foundation from which to learn additional cutting techniques.

The best way to envision these cuts is by the use of a rectangle that extends through the tree. The bottom corner is the back of the face's horizontal cut. The opposite upper corner will be the back of the backcut.



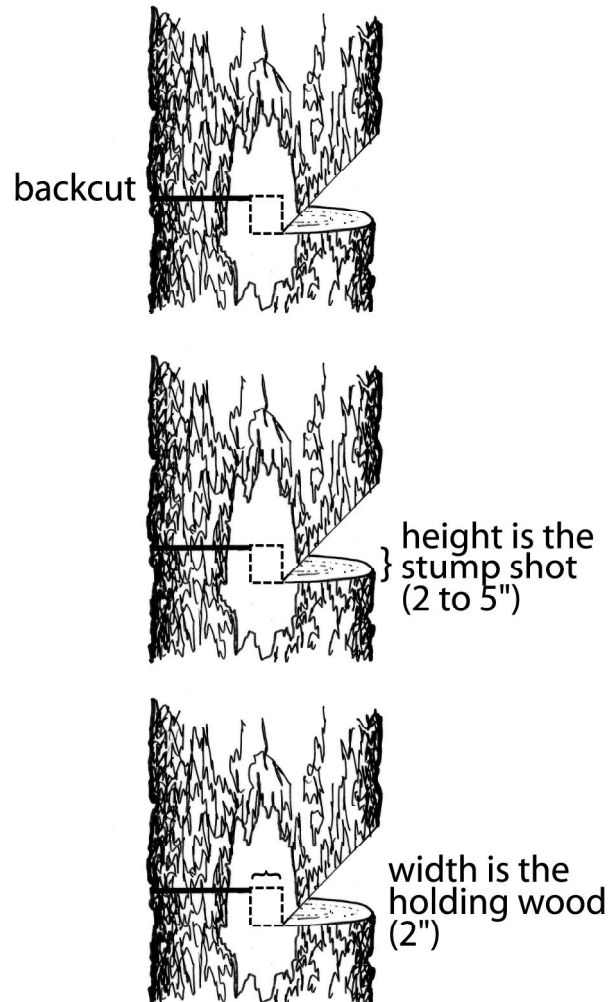
The height of the rectangle is referred to as the stump shot. It is an anti-kickback device to prevent the tree from kicking back over the stump if it hits another tree during its fall. This is especially important when felling trees through standing timber.

The width of the rectangle is the holding wood. As the backcut is made, the sawyer must be careful not to cut this wood. Maintaining the holding wood is the key to safe and effective felling.



It takes three cuts to fell a tree. Two cuts form the undercut (or face cut) and the third forms the backcut. The correct relationship of these cuts results in safe and effective tree felling.

Before discussing the felling procedure, we will analyze the mechanics of the felling cuts. Undercutting and backcutting construct the hinge that controls the direction and fall of the tree.



- a. The undercut serves two purposes:
- First, it directs the tree to fall in the chosen path by removing the tree's support in the direction of the face cut.
  - Second, it enables control because hinge determines how far the tree will fall before breaking the hinge wood, guiding the tree to the intended lay.

The undercut consists of two cuts: a gunning or horizontal cut, and a sloping cut. Observe overhead hazards and look up often during the undercut.

You should be standing all the way up, with the saw comfortably held at waist level. If slope or other factors prevent standing, body position should be down on one knee.

The tree is faced in the general direction of the tree's predominate lean. Ideally, the undercut is made in the same direction as the tree's lean, but because of structures, roads, other trees, or trails, the desired felling direction may be to one side or the other of the lean. Normally, the desired direction is less than 45° from the lean.

After selecting the desired felling direction, estimate one-third the tree's diameter, and mark the hinge wood rectangle in the tree. If the tree has thick bark, remove it from an area on both sides of the tree along the plane of the gunning cut. The bark can be removed with the falling axe or with the chain saw. Use caution in case the axe glances off the bole or the saw kicks back.

Set the saw's dogs at the bottom corner of the hinge rectangle, and begin the horizontal cut.

The gunning cut is a level cut. This cut is made at a height comfortable for the sawyer, usually at standing waist height. The gunning cut dictates the direction of fall if the relationships of the three cuts are maintained. *If there is any danger from above, such as snags, the cutting should be done while standing so the sawyer can watch the top and escape more quickly.*

The specific direction of the undercut is determined by “gunning” the saw. Look down the gunning marks on the saw and align them parallel with the desired felling direction. After the gunning cut has been made level to at least one-third of the tree’s diameter, the horizontal cut is complete.

Short snags sometimes require an undercut deeper than one-third the tree’s diameter to offset the tree’s balance. Trees with heavy leans may not allow the sawyer to make the horizontal cut as deep as one-third of the tree’s diameter without pinching the guide bar.

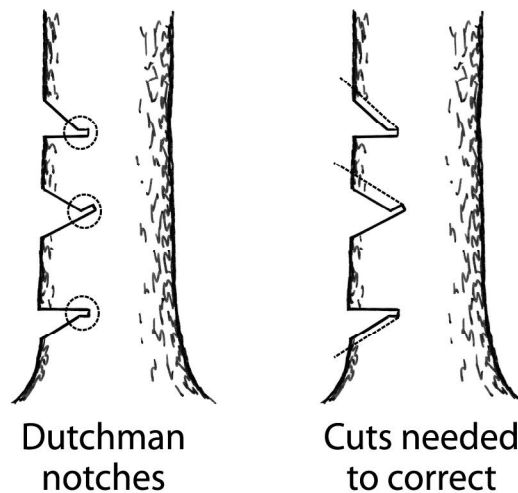
The sloping cut needs to be angled so that when the face closes the tree is fully committed to the planned direction of fall. As the face closes, the hinge/holding wood breaks. If this happens and the tree is still standing straight, the tree could fall away from the predetermined lay.

As a general rule, make the sloping cut at a 45° angle. Remember that it is important that the face not close until the tree is fully committed to the planned direction of fall.

Start the cut above the top corner of the hinge on the face side and draw the saw down to the corner of the gunning cut. Allow the chain to stop, leave the bar in place in the cut, pull the saw back and sharply force the dogs into the trunk. This will maintain the angle of the sloping cut across the face of the tree.

Line up the sloping cut with the gunning cut so that they meet, but do not cross. When the cuts cross, a “dutchman” is formed. If the tree were felled with a dutchman, first the dutchman would close, then the tree would split vertically (barber-chair), or the hinge wood would break off unevenly. Felling control would be lost. A weak tree might snap off somewhere along the bole or at the top.

It is difficult to make the sloping cut and the horizontal cut meet correctly on the opposite side of the tree. This is because the point of intersection is not immediately visible to the sawyer.



After making a short sloping cut, leave the saw running in the cut. Engage the chain brake. Go around to the off side of the tree and see if the guide bar is in the correct plane to intersect the back of the horizontal cut.

Keep your hands away from the throttle trigger. If the gunning cut cannot be easily seen, insert a clean stick in the off-side gunning cut as a reference marker.

Look down through the top of the bar to determine if the bar and stick are properly aligned at the 45° angle. If they are not, estimate the correct angle and adjust the bar angle to achieve the correct sloping cut. Practicing on high stumps will help you become skilled at lining up these cuts.

- b. The hinge, or holding wood, is the wood immediately behind the undercut (notch). The gunning and sloping cuts **must not** overlap each other. If they do, the undercut must be cleaned up so no dutchman is present.

The corners are the holding wood at the ends of the face cut, in the first 2 to 8 inches inside the bark. The horizontal and sloping cuts must not overlap in this portion of the undercut, creating a dutchman.

Care must be taken not to cut the undercut too deeply while cleaning up. This reduces the amount of room available for wedges in the backcut.

If cleaning up the sloping cut will create too deep an undercut, stop the sloping cut directly above the end of the horizontal cut.

The undercut needs to be cleaned out. Any remaining wood will cause the face to close prematurely and the holding wood will be broken behind the closure.

Once the face has been cleaned, recheck the felling direction. Place the dogs back in the holes left while making the gunning cut and check the gunning marks or place an axe head into the face and look down the handle.

The gunning sights can be used in reverse to help determine the guide bar's position. The back of the undercut should be perpendicular to the desired felling direction.

If the tree is not aimed in the direction that you want it to fall, extend the horizontal and sloping cuts as needed, maintaining a single plane for each of the two cuts.

c. Backcut and wedging procedures

The third cut needed to fell a tree is the backcut. The relationship of this cut to the face is important for proper tree positioning and the sawyer's safety.

The backcut can be made from either side of the tree if the saw has a full-wrap handlebar. Choose the safest side to cut on.

In the area where you have removed the bark for marking the falling rectangle, place the dogs so the chain will cut no closer than 2" from the face and 2" above the gunning cut.

For large diameter trees the backcut may have to be as much as 5" above the horizontal cut to ensure adequate stump shot. You may place the dogs closer than 2" on small trees (less than 10" dbh) with lightweight tops.

Give a warning shout before starting the backcut. Start the backcut with the dogs placed so the chain will end in the upper corner of the hinge wood rectangle.

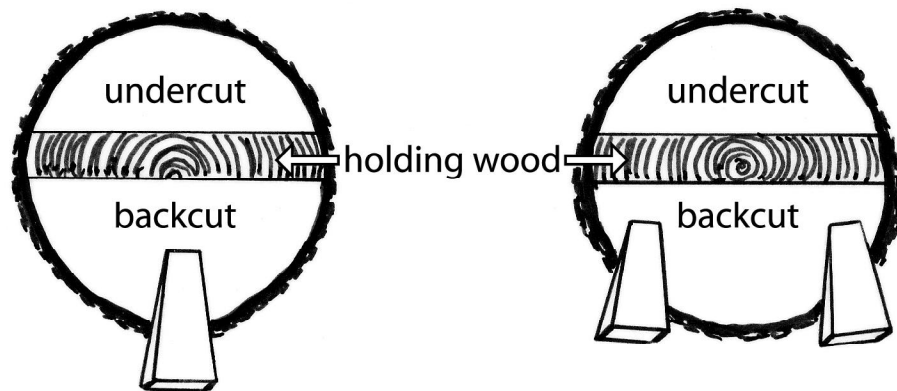
Hold the saw level so that the backcut will be level when the cut is complete. Ensure that when the cut is finished it will line up with the top corner of the opposite end of the rectangle. If the cut is angled, wedging power and/or the stump shot's height will be altered.

It may be helpful to cut or chop the bark to help level the bar. Do not cut deeper than the bark. Cuts into the wood will eliminate or reduce wedging lift. Once the backcut has been made into the wood, do not change the backcut's location.

Keep at least three wedges and an axe readily accessible while making the backcut. The wedges should be in a wedge holster worn on the chap's belt or in a pants pockets.

Keep the axe within arm's reach. The size of the wedge depends on the tree's diameter. For a 24" tree, two 10-12" wedges and one 4-6" wedge is a good combination.

Remove thick bark immediately above and below the backcut's kerf where wedges will be placed. The bark will compress, lessening the lifting power of the wedges. The wedges should be spread to better stabilize the tree in case of erratic winds.



If there is any wind at all, at least two wedges are recommended. The second wedge adds stability. With only one wedge, the tree can set up a rocking action between the holding wood and the wedge. If a strong wind begins to blow, the holding wood can be torn out.

## 2. Directional felling

Place wedges in the kerf in each area as soon as the bar's travel will permit. Place the wedges parallel to the desired felling direction. Do not drive the wedges too hard. They will interfere with the backcut or cause the tree to become a heavy leaner.

Watch for droop in the wedges as the backcut progresses, and occasionally try to push them in with your hands. Retighten them with the axe every 4 to 6" of cutting.

Be careful not to drive the wedges too hard. They may bounce out of the kerf, cause the hinge to break prematurely, or the pounding may set up a dynamic response in the tree, causing material to fall on the sawyer.

The wedges are there in case the lean was incorrectly established, the wind causes the tree to set back, or the sawyer intends to fell the tree in a different direction from the tree's natural lean.

As you cut, continually look above for possible hazards and at the kerf for movement. **Do not cut into the holding (hinge) wood.**

With the correct lean established and the proper relationship between the three cuts, the face will begin to close and the tree will fall in the planned direction.

## 3. Wedging small diameter trees

Wedges must be used for all felling operations. Small trees limit the sawyer's use of wedges, even when small wedges are used. A technique can be employed where half of the back cut is made at a time. This allows for wedges to be placed without interfering with the guide bar.



It is desirable to use a chain saw equipped with a full-wrap handlebar, making it easier to use the bottom corner of the guide bar tip, reducing the chance of kickback.

After making the undercut, cut half of the backcut using the guide bar's tip. Make this cut from the tree's offside. Watch out for kickback and be careful not to cut the holding wood.

Finish the backcut from the other side. Leave the appropriate amount of holding wood across the tree, depending on diameter 1 to 1½ inches of holding wood.

After removing the saw, place a small wedge in the kerf an inch or more from the remaining wood to be cut. Remember to keep the wedge tight but do not drive the wedge too hard.

Finish the backcut using the tip of the guide bar, being prepared for kickback from the wedge. The wedge will be in position if the tree sits back. If two wedges are needed to lift the tree into the undercut, spread them as widely as possible.

For trees that have a moderate amount of side lean, two wedges may be inserted on the side of the backcut that has been cut first. As with other wedging operations, it is essential to tighten the wedges often, especially on trees that are attempting to sit back.

A sitback is a tree that settles back opposite the intended direction of fall during the backcut. This normally happens because the lean was incorrectly established or the wind changed direction.

If the sawyer has been following the proper felling procedure (there is a wedge in the backcut and the holding wood has been maintained), a sitback can be dealt with readily.

If the proper felling procedure has not been followed, the sawyer will need assistance because the tree has probably pinched the bar.

Immediately notify your supervisor in the case of sitbacks and other felling difficulties to determine methods and skill level required to resolve the problem.

Before you leave a hazard tree, be sure to clearly mark the area with flagging or with a written warning. Give a verbal warning to others working in the area.

#### 4. Falling snags

Remember: **Stay within your skill level.** If a falling task exceeds your skill level or your “gut” is uncomfortable, refuse the falling assignment and request a qualified faller for the task.

A snag is a standing dead tree, or portion of a tree. They may be either sound (recently dead or the integrity of the wood fibers is intact), or soft (the wood fibers have decayed and the snag is punky).

Shout a warning. Before working on a snag, everyone in the area must be notified. Remember a snag can fall in any direction at any time.

Observe the top. Pay special attention to overhead hazards, branches, and the snag’s top. Upper limbs may be weak and ready to come down at the least vibration.

Never cut directly below a hazard. Look up while driving wedges.

Swamp out the base. Carefully check the condition of the bark on the snag. Loose bark can come sliding down the side of the snag and presents an extreme hazard to the sawyer. Standing back with room to escape, remove loose bark at the snag's base by prying it with an axe or a pole. Do not chop the bark, because this would set up vibration in the snag.

Size up. Check the condition of wood by boring into it with the bar tip. Maintain the integrity of the holding wood. When sounding with an ax, look up while striking the tree. Check for frost cracks and other splits in the holding wood.

Determine two escape routes. Since the holding wood is rotten to some degree, you must establish two routes of escape. The gunning sights can be used in reverse to help determine the guide bar's position.

Select the appropriate lay. **Do not fell a snag against its lean.** Make the undercut and the backcut while standing upright. You are in a position where you can easily look up, and less of your body is exposed to falling debris. In addition, you are in a position that allows immediate escape.

When you are cutting the face, be alert for the snag pinching the bar. Previous boring in the undercut area during sizeup should alert you to this possibility. Moving the bar back and forth will minimize the possibility of pinching.

If the snag starts to sit on the bar, finish the undercut just to that depth. It is critical that the undercut has a wide opening and that it be cleaned out from corner to corner.

A short snag, with few or no limbs to give it lean, may need a face up to one-half the snag's diameter to offset the balance. Always flag any tree too dangerous to fall.